IN THE CLAIMS

CLAIMS

1. (Currently amended) A software-based, flexible computer architecture for communication and cooperation among distributed electronic agents, the architecture contemplating a distributed computing system comprising:
a plurality of service-providing electronic agents;
a distributed facilitator agent functionally distributed across at least two computer processes, the facilitator agent capable of bi-directional communications with the plurality of service-providing electronic agents, the facilitator agent including:
an agent registry that declares capabilities for each of the plurality of service-providing electronic agents currently active within the distributed computing environment; and
a facilitating engine operable to interpret a service request as a base goal, the facilitating engine further operable for generating a goal satisfaction plan associated with the base goal, wherein the goal satisfaction plan involves:
using reasoning to determine sub-goal requests based on non-syntactic decomposition of the base goal and using said reasoning to co-ordinate and schedule efforts by the service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal.; and
wherein the plurality of service-providing electronic agents and the distributed facilitator agent communicate using an interagent Communication Language (ICL), wherein the ICL includes:
a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more

events.

2. (Original) A software-based, flexible computer architecture as recited in claim 1 wherein the distributed facilitator agent includes a plurality of single process facilitator agents each executing within a separate computer process, each of the single process facilitator agents being bi-directionally coupled with at least one other single process facilitator agent.

3. (Previously presented) A software-based, flexible computer architecture as recited in claim 2 wherein each single process facilitator agent has any necessary facilitating functionality, a specific single process facilitator including:

a specific agent registry that declares capabilities for each of the plurality of service-providing electronic agents currently active within the process wherein the specific single process is executing, the specific agent registry further declaring capabilities made available to the specific single process facilitator agent through the at least one other single process facilitator agent bi-directionally coupled with the specific single process facilitator agent; and

a specific facilitating engine operable to interpret a service request as a base goal, the specific facilitating engine further operable to determine sub goals required to complete the base goal; the specific facilitating engine further operable to select service providing agents best capable of completing the sub goal and assigning the sub goals thereto.

4. (Original) A software-based, flexible computer architecture as recited in claim 3 wherein at least two of the plurality of single process facilitator agents reside upon separate computer systems.

5. (Currently amended) A computer architecture as recited in claim 1, wherein the ICL enables ~~4, wherein the basis for the computer architect is an~~

~~Interagent Communication Language (ICL) enabling~~ agents to perform queries of other agents, exchange information with other agents, and set triggers within other agents, the ICL further defined by an ICL syntax supporting compound goal expressions such that goals within a single request provided according to the ICL syntax may be coupled by a conjunctive operator, a disjunctive operator, a conditional execution operator, and a parallel disjunctive operator that indicates that disjunctive goals are to be performed by different agents.

6. (Original) A computer architecture as recited in claim 5, wherein the ICL is computer platform independent.

7. (Original) A computer architecture as recited in claim 6 wherein the ICL is independent of computer programming languages in which the plurality of agents are programmed.

8. (Original) A computer architecture as recited in claim 7 wherein the ICL syntax supports explicit task completion constraints within goal expressions.

9. (Original) A computer architecture as recited in claim 8 wherein possible types of task completion constraints include use of specific agent constraints and response time constraints.

10. (Original) A computer architecture as recited in claim 8 wherein the ICL syntax supports explicit task completion advisory suggestions within goal expressions.

11. (Original) A computer architecture as recited in claim 5 wherein the ICL syntax supports explicit task completion advisory suggestions within goal expressions.

12. (Original) A computer architecture as recited in claim 5 wherein each autonomous service-providing electronic agent defines and publishes a set of

capability declarations or solvables, expressed in ICL, that describes services provided by such electronic agent.

13. (Original) A computer architecture as recited in claim 12 wherein an electronic agent's solvables define an interface for the electronic agent.

14. (Original) A computer architecture as recited in claim 1 wherein the distributed facilitator agent is formed in a hierarchical topology.

15. (Original) A computer architecture as recited in claim 14 wherein the hierarchical topology includes a top level facilitator agent and at least one other facilitator agent registered within the top level facilitator agent, the top level facilitator agent operable to directly manage those service-providing agents registered within the top level facilitator agent and indirectly manage those service-providing agents registered within the at least one other agent registered with the top level facilitator agent.

16. (Original) A computer architecture as recited in claim 15 wherein the top level facilitator agent and the at least one other facilitator agent are executing on different computer systems.

17. (Original) A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific computer user.

18. (Original) A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific group of users.

19. (Original) A computer architecture as recited in claim 15 wherein the at least one other facilitator agent is installed for a specific computer application.

20. (Original) A computer architecture as recited in claim 1 wherein the distributed facilitator agent includes a planning component executing within a first computer process and an execution component executing within a second computer process.

21. (Original) A computer architecture as recited in claim 20 wherein the planning component is one of a plurality of synchronized planning components each executing with separate computer processes, whereby the computer architecture provides a more robust operating environment due to redundancy of the planning component functionality of the distributed facilitator agent.

22. (Currently amended) A software-based flexible computer architecture for communication and cooperation among distributed electronic agents, the architecture contemplating a distributed computing system comprising:
a plurality of service providing electronic agents;
at least one facilitator agent capable of receiving a service requests in the form of a base goal from a service-requesting agent in an interagent communication language (ICL) and capable of determining sub goals necessary to accomplish the base goal, the facilitator agent operable to allocate each sub-goal to at least one service-providing agent capable of accomplishing the sub-goal as determined by the registry, the facilitator agent being distinct from service-providing agents, wherein the ICL includes a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events; and
at least one service-requesting agent capable of making a request directly to a service-providing agent as a peer to peer communication for accomplishment of at least one of the sub-goals.

23. (Original) A software based, flexible computer system as recited in claim 22 wherein the peer to peer communication is in a language other than an interagent communication language.

24. (Original) A software based, flexible computer system as recited in claim 22 wherein the peer to peer communication is bi-directional.

25 (Original) A software based, flexible computer system as recited in claim 22 wherein the agent operable to make said peer to peer service request is said facilitator agent.

26. (Currently amended) A distributed facilitator agent functionally distributed across at least two computer processes, the distributed facilitator agent arranged to coordinate cooperative task completion within a distributed computing environment having a plurality of autonomous service-providing electronic agents, the distributed facilitator agent comprising:

an agent registry that declares capabilities of service-providing electronic agents currently active within the distributed computing environment; and

a facilitating engine operable to parse a service request in order to interpret a compound goal set forth therein, the service request formed according to an Interagent Communication Language (ICL), the ICL including a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events, the facilitating engine further operable to generate a goal satisfaction plan associated with the compound goal, wherein the goal satisfaction plan involves:

using reasoning to determine sub-goal requests based on non-syntactic decomposition of the base goal and using said reasoning to co-ordinate and schedule efforts by the service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal.

27. (Original) A facilitator agent as recited in claim 26, wherein the facilitating engine is capable of modifying the goal satisfaction plan during execution, the modifying initiated by events such as new agent declarations within the agent registry, decisions made by remote agents, and information provided to

the facilitating engine by remote agents.

28. (Original) A facilitator agent as recited in claim 26 wherein the agent registry includes a symbolic name, a unique address, data declarations, trigger declarations, task declarations, and process characteristics for each active agent.

29. (Original) A facilitator agent as recited in claim 26 wherein the facilitating engine is operable to install a trigger mechanism requesting that a certain action be taken when a certain set of conditions are met.

30. (Original) A facilitator agent as recited in claim 29 wherein the trigger mechanism is a communication trigger that monitors communication events and performs the certain action when a certain communication event occurs.

31. (Original) A facilitator agent as recited in claim 29 wherein the trigger mechanism is a data trigger that monitors a state of a data repository and performs the certain action when a certain data state is obtained.

32. (Original) A facilitator agent as recited in claim 31 wherein the data repository is local to the facilitator agent.

33. (Currently amended) A facilitator agent as recited in claim 31 ~~26~~ wherein the data repository is remote from the facilitator agent.

34. (Original) A facilitator agent as recited in claim 29 wherein the trigger mechanism is a task trigger having a set of conditions.

35. (Previously presented) A facilitator agent as recited in claim 26, the facilitator agent further including a global database accessible to at least one of the service-providing electronic agents.

36. (Previously presented) A facilitator agent as recited in claim 26 wherein the distributed facilitator agent includes a plurality of single process facilitator agents each executing within a separate computer process, each of the single process facilitator agents being bi-directionally coupled with at least one other single process facilitator agent.

37. (Previously presented) A facilitator agent as recited in claim 36 wherein each single process facilitator agent has any necessary facilitating functionality, a specific single process facilitator including:

a specific agent registry that declares capabilities for each of the plurality of service-providing electronic agents currently active within the process wherein the specific single process is executing, the specific agent registry further declaring capabilities made available to the specific single process facilitator agent through the at least one other single process facilitator agent bi-directionally coupled with the specific single process facilitator agent; and

a specific facilitating engine operable to parse a service request in order to interpret an arbitrarily complex goal set forth therein, the specific facilitating engine further operable to construct a goal satisfaction plan using reasoning to determine sub-goal requests based on non-syntactic decomposition of the base goal and using said reasoning to co-ordinate and schedule efforts by the service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal.

38. (Original) A facilitator agent as recited in claim 37 wherein at least two of the plurality of single process facilitator agents reside upon separate computer systems.

39. (Original) A facilitator agent as recited in claim 38 wherein the distributed facilitator agent is formed in a hierarchical topology.

40. (Original) A facilitator agent as recited in claim 39 wherein the hierarchical topology includes a top level facilitator agent and at least one other facilitator agent registered within the top level facilitator agent, the top level facilitator agent operable to directly manage those service-providing agents registered within the top level facilitator agent and indirectly manage those service-providing agents registered within the at least one other agent registered with the top level facilitator agent.

41. (Original) A facilitator agent as recited in claim 40 wherein the top level facilitator agent and the at least one other facilitator agent are executing on different computer systems.

42. (Original) A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific computer user.

43. (Original) A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific group of users.

44. (Original) A facilitator agent as recited in claim 40 wherein the at least one other facilitator agent is installed for a specific computer application.

45. (Previously presented) A facilitator agent as recited in claim 26 wherein the distributed facilitator agent includes a planning component executing within a first computer process and an execution component executing within a second computer process.

46. (Original) A facilitator agent as recited in claim 45 wherein the planning component is one of a plurality of synchronized planning components each executing with separate computer processes, whereby the computer architecture provides a more robust operating environment due to redundancy of the planning component functionality of the distributed facilitator agent.

47. (Currently amended) A facilitator agent for coordinating cooperative task completion within a distributed computing environment having a plurality of autonomous service-providing electronic agents, the ~~distributed~~ facilitator agent comprising:

a registry of capabilities of the service-providing electronic agents; and

a facilitating engine operable to determine a set of sub goals necessary to accomplish a base goal, and then allocate such sub-goals to those agents capable of accomplishing the sub-goals as determined by the registry, said facilitating agent further capable of initiating a direct peer to peer communication between a service-requesting agent and a service-providing agent of at least one sub-goal, and said facilitating agent being distinct from service-providing agents~~.~~; and

wherein the service-providing agent and the service-requesting agent communicate using an Interagent Communication Language (ICL), the ICL includes a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events.

48. (Canceled)

49. (Original) A facilitator as set forth in claim 47 wherein the facilitator agent is functionally distributed across at least two electronic agents.

50. (Original) A facilitator as set forth in claim 49 wherein the peer to peer communication is between said distributed facilitator agents.

51. (Currently amended) A computer-implemented method for providing cooperative task completion within a distributed computing environment, the distributed computing environment including a plurality of autonomous electronic agents, the distributed computing environment supporting an Interagent Communication Language, the computer-implemented method comprising the acts of:

providing a plurality of synchronized agent registries each declaring capabilities of service-providing electronic agents currently active within the distributed computing environment, the plurality of synchronized agent registries each resident within a separate computer process;

interpreting a service request in order to determine a base goal, the service request adhering to ~~an~~ the Interagent Communication Language (ICL), the ICL including a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events, the act of interpreting including the sub-acts of:

determining a goal satisfaction plan that is associated with the base goal;

wherein the goal satisfaction plan involves:

using reasoning to determine sub-goal requests based on non-syntactic decomposition of the base goal and using said reasoning to co-ordinate and schedule efforts by the service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal; and

implementing the base goal satisfaction plan.

52. (Original) A computer implemented process as recited in claim 51 wherein the step of interpreting a service request is controlled by a computer process separate from the computer processes wherein the plurality of synchronized agent registries reside.

53. (Currently amended) A computer implemented process for providing coordinated task completion within a distributed computing environment, the distributed computing environment including a plurality of autonomous electronic agents, the computer implemented method comprising the steps

of:

providing at least one agent registry including capabilities of service providing electronic agents;

interpreting a service request in the form of a base goal, the service request being in a interagent communication language (ICL), the ICL including a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events;

determining a plurality of sub goals necessary to accomplish the base goal;

selecting from said registry at least one service providing agent capable of completing said sub goals;

delegating at least one sub goal as a peer to peer service request directly from a service requesting agent to a service providing agent; and

delegating any remaining sub goals as service request in the interagent communication language to the selected agents capable of completing the remaining sub-goals.

54. (Currently amended) A computer-implemented method for providing cooperative task completion within a distributed computing environment, the distributed computing environment including a plurality of autonomous electronic agents, the distributed computing environment supporting a dynamically expandable Interagent Communication Language ("ICL"), the computer implemented method comprising the acts of:

providing a plurality of synchronized agent registries each declaring a set of functional capabilities for one or more of the autonomous service-providing electronic agents, each of the synchronized agent registries being resident within a separate computer process;

receiving a service request adhering to the ICL, the ICL including a layer of conversational protocol defined by event types and parameter lists associated with one or more of the events, wherein the parameter lists further refine the one or more events;

determining a base goal based on the service request;

determining a delegation plan wherein the delegation plan involves:

using reasoning to determine sub-goal requests based on non-syntactic decomposition of the base goal and using said reasoning to co-ordinate and schedule efforts by the autonomous service-providing electronic agents for fulfilling the sub-goal requests in a cooperative completion of the base goal; and

implementing the delegation plan.

55. (Original) A computer implemented method as recited in claim 54 wherein the act of providing a plurality of agent registries further includes replicating at least a portion of one or more of the synchronized agent registries across a plurality of separate computer processes.

56. (Original) A computer implemented method as recited in claim 54 wherein the act of implementing the delegation plan is controlled by a computer process separate from the computer processes wherein the plurality of synchronized agent registries reside.